NOvA

Conceptual cabling design

To power Electronics

Cecil Needles

HV cost for NOvA

- 1 HV channel = 128 modules
- HV = 500v @ .5uA per module.
- 23808 APD modules at 128 APD modules per HV channel = 186 HV channels needed.
- 186 channels / 12 channels per HV card = 15.5 cards =16 HV cards (CAEN A1520P)
- Six A1520P HV cards per power supply system (CAEN SY2527) 16/6 = 2.66 = 3 power supply systems.

Cable for NOvA HV modules

- HV Cable at 53ft per plane X 10 planes per HV channel = 530ft
- 530ft + 100ft average to HVPS X 186 cables = 117,180ft.
- 117,180ft at $.34per/ft = $39,841.20 for Alpha (TYPE5616B1601) two conductor AWG16 shielded 600v instrumentation cable. ($.30)?
- to install cables = 150ft/ man hour / 117,180ft = 781.2mh X $45 = $35,154
- Cable connector for HV modules (AMP 201310-3)
- Cost of parts for one HV card connector = $387.60
- 16 HV cards x $387.60 = $6201.60
- 32 man hours to install connectors $45 X 32 = $1440
- Wire connector to module @ $.50ea. 23808 connections X $.50 = $11,904. AMP type 641533-1 two position + contacts type 640250-1
- Need a pig tail for the HV daisy chain to module connection.
- 47616 connections @ $.50 = $23,808
- Man hours to make a pigtail for HV cable connection to each module (6 minute X 23808 / 60 X $45 = $107,136).

12 volts for diode cooling (TEC).

- 12 volt Power supply at .25amp for each TE Coolers.12 TEC/plane X.25 = 3 amp ~ 5 amp for overhead. 100amp supply / 5amp = 20 planes/100amp supply.
- One power fan out for 20 planes. 1984 planes/20 = 100 fan outs.(99.2)
- 346ft of 16AWG wire/plane X 1984 number of planes = 686,464ft. 686,464ft x $.25/ft = $171,616
- 686,464ft / 150ft per man hr = 4576.43 man hrs
- 4576.43 man hours to install cable X $45 = $205,939.35
- 2min per connector X 2 connectors X 23808 connections /60min = 1587.2 man hours to install connectors $45 X 1587.2 = $71,424
- 47616 -2 pin cable connectors @ $.50 = $23,808
- Average high current cable 10ft X 100 cables 1,000ft. 150ft per man hr = 7 man hours to install cable $45 X 7 = $315
- 8 man hours to install one 100 amp fan out
- $45 X 8hr X 100 fan-outs = $36,000

3 volts for readout electronics.

- 3 volt Power supply at 1 amp for each APD box. 12 APD box /plane = 100amp/12amp = 8 planes per 100amp supply.
- One power fan out for 8 planes. 1984 planes/8 = 248 fan outs.
- 306ft of 16AWG wire per plane X 1984 number of planes = 607,104ft. 607104ft x $.25/ft = $151776
- 607,104ft / 150ft per man hr = 4047.36 man hrs
- 4047.36 man hours to install cable X $45 = $182,131.20
- 2min per connector X 2 connectors X 23808 connections /60 minutes per hour =1587.2 man hours to install connectors = $45 X 1587.2 = $71,424
- 47616 2 pin cable connectors @ $.50 = $23,808
- Average high current cable 10ft X 248 cables 2,480ft. 150ft per man hr = 17 man hours to install cable $45 X 17 = $768
- 4 man hours to install one 100 amp fan out
- $45 X 4hr X 248 fan-outs = $44,640

Low voltage layout

- 12v power supply -
- 20 back planes with five 100amp power supplies every 20ft.
- 100 fan-outs one every 4ft.
- 240 modules per fan-out or 20 planes per fan-out
- 20 planes = 48”
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- 3v power supply -
- 50 back planes with five 100amp power supplies every 8ft.
- 248 fan-outs one every 1.6ft
- 96 modules per fan-out or 8 planes per fan-out
- 8 planes = 19.2”
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Cable for low voltage high current power feed line

- 3v average 10ft of AWG 2/0 X $2.52 X 248 cables = $ 6,250
- 12v average 10ft of AWG 2/0 X $2.52 X 100 cables = $ 2,520
- Connectors crimp lug 348 X 2 X $1.84 = $988.32

- Total = $13,758.32

3v 100amp fan-out

- 96 1.5 amp Fuses @ $0.89 = 85.44
- Pc board 5.5” X 19.5” @ $30.00
- Buss bare @ $10.00
- Box 6” X 4” X 20” @ $50.00
- 96 PC connect /8pins X 12 AMP 640389-8 @ $3.50 = $42.00
- Labor 4 man hours to assemble one Power fan out.
- $45 X 4hr each fan-out = $180
- Sum = $397.44
- Total for fan-outs $397.44 X 248 = $98,565.12

12 volt 100amp fan-out

- 240> .5 amp Fuses @ $0.88 = $211.20
- Pc board 5.5” X 49.5” @ $76.00
- Buss bare @ $30.00
- Box 6” X 4” X 50” @ $90.00
- 240 Connectors @ $03.50 = $840.00
- Laber8 man hours to package one Power fan out.
- $45 X 8hr each fan-out = $360
- Sum = $1,607.20
- Total for fan-outs $1,607.20 X 100 = $160,720.00

Total cost

- Alpha 2 600v cable = $ 39,841.00
- 12v16awg PS cable = $ 171,616.00
- 3v16awg PS cable = $ 151,776.00
- High current cable = $ 8,770.00
- Connectors = $ 90,517.00
- Fan out boxes = $ 259,385.00
- Labor = $ 759,064.00
- Total = $ 1,480,969.00